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# STORAGE

REPORT  
OF  
THE DIRECTOR  
OF THE  
ROYAL OBSERVATORY, HONGKONG,  
FOR THE YEAR .

1919



HONGKONG  
PRINTED BY NORONHA & Co.  
GOVERNMENT PRINTERS

1920







# REPORT OF THE DIRECTOR OF THE ROYAL OBSERVATORY, HONGKONG, FOR THE YEAR 1919.

## I.—GROUNDS AND BUILDINGS.

The grounds were kept in order by the Botanical and Forestry Department with the assistance of the Observatory coolies.

A portion of the area between the main building and the servants' quarters was covered with concrete in March.

Four water closets were installed in May.

Many books and records were destroyed by white ants during the summer months, notwithstanding frequent airing and painting the book cases with Atlas solution.

## II.—METEOROLOGICAL INSTRUMENTS.

*Barometers.*—Casella No. 2451 was repaired by the makers and returned in December.

Comparisons between this barometer and the Observatory Standard gave for the index correction of the latter — '010<sup>in.</sup> as against an adopted correction of — '007<sup>in.</sup>

*Kew Barograph.*—This instrument is to be superseded by a Marvin compensated syphon barograph, which is expected shortly.

*Beckley Anemograph.*—This instrument was oiled once a month, and the orientation of the head checked.

*Dines Baxendell Anemograph.*—The head was oiled once a month, and the spindle of the float cleaned and oiled once a week. The orientation of the head was checked monthly.

The mean monthly results of comparisons with the records of the Beckley Anemograph from 1910-1918 are given in the following table, together with the results for 1919 :—

Month.	Factor ( $\text{Dines} \div \frac{\text{Beckley}}{3}$ ).	
	Mean 1910-1918.	1919.
January, .....	2'14	1'78
February, .....	2'20	1'78
March, .....	2'19	1'99
April, .....	2'18	2'00
May, .....	2'21	1'99
June, .....	2'22	1'85
July, .....	2'32	2'03
August, .....	2'32	2'06
September, .....	2'30	2'20
October, .....	2'23	2'18
November, .....	2'15	2'01
December, .....	2'11	1'72
Year, .....	2'21	1'97

The scale value of the instrument was determined in the month of May, 1918, by means of a gauge constructed at the Observatory. It appeared to be correct within the probable error of observation, which was about 1 mile at a velocity of 80 m.p.h., increasing to 3 miles at 10 m.p.h.

*Dines Baxendell Anemograph for Gap Rock.*—This instrument was received in September, and the scale value tested. It was found that when the float was weighted to give the scale value engraved on the sheet ( $1m. = 0^{in}.06$ ) the water encroached on the conical portion of the float. It is proposed to adjust the float until  $\frac{1}{20}$  of an inch of the cylindrical portion appears above the level of the water, and determine the scale value once a month under these conditions, measuring the records with an appropriate scale.

Plans have been prepared for the iron structure required for its erection on the lightkeepers' quarters at Gap Rock and it is expected that the installation will be finished in February.

*Thermometers.*—All thermometers in use were compared with the Kew Standard in winter and summer.

*Thermograph.*—The Richard dry and wet bulb thermograph has worked satisfactorily during the year. Its records, which are standardised by hourly readings of the rotation thermometers, indicate that the relation between the temperature in the thermograph shelter and in the open air is not constant throughout the day.

The records are time-scaled electrically. An electro-magnetic circuit is closed by a make-contact on one of the electric dials at the 60th minute of every hour and opened at the 3rd minute. The electro-magnet lifts the pens from the paper and thus interrupts the record for the first three minutes of every hour.

The thermometers are aspirated from the 59th to 60th minute of each hour by an electric fan operated through a special relay by a similar contact on another dial.

*Sunshine Recorder.*—The shadow of the wireless mast, erected in the summer of 1917, falls on the sunshine recorder for a few minutes in the afternoon from January 16th to March 29th and September 16th to November 28th. The mast has a skeleton frame, the ribs of which partially eclipse the sun and occasionally cause a slight loss of register. A more serious loss occurs when the sun passes behind the joints of the mast (which are steel plates 3 feet square) or when sun sets behind the mast. A list of corrections to the sunshine values in Tables V and IX of the Monthly Meteorological Bulletin, on account of this interruption, is given in the December Bulletin. The correction is never large enough to affect the values given in Table XI.

*Peak Anemograph.*—The naval signalmen who looked after the Peak Anemograph were withdrawn by the Naval Authorities in May. It has since been necessary to send an assistant from the Observatory to change the sheet. From motives of economy the sheet is only changed once in two days. The consequent overlapping of the register is objectionable but will, it is hoped, soon



cease, the local Government having decided to re-open the station as a signal station, and utilise the services of the signalman for looking after the anemograph and making meteorological observations six times daily.

### III.—METEOROLOGICAL OBSERVATIONS AT THE OBSERVATORY.

Automatic records of the temperature of the air and evaporation were obtained with a Richard dry and wet bulb thermograph and of the direction and velocity of the wind with a Beckley and a Dines-Baxendell anemograph, modified as described in the report for 1912. The amount of rain is recorded automatically by a Nakamura pluviograph, the amount of sunshine by a Campbell-Stokes universal sunshine recorder, and the relative humidity of the air by a small Richard hair hygograph. Eye observations of barometric pressure, temperature of the air and of evaporation, and the amount of cloud were made at each hour of Hongkong Standard time. The character and direction of the motion of the clouds were observed every three hours. Daily readings were taken of self-registering maximum and minimum thermometer.

Photographic Registration with the Kew barograph ceased when the supply of bromide paper was exhausted on November 16th, 1919. A Marvin compensated syphon barograph, ordered last year, was expected before this date but has not yet arrived.

*Principal Features of the Weather.*—The principal features of the weather in 1919 were:—

- (a) The large departures from normal from month to month in atmospheric pressure, temperature and wind.
- (b) A typhoon, which produced a wind velocity of 60 m.p.h. at 7 p.m. on the 22nd August, and a squall at the rate of 84 m.p.h. at 1h. 17m. p.m. on the 22nd, although the centre passed about 150 miles to the south-west of Hongkong.
- (c) Heat waves from June 15th to July 3rd, July 8th to 25th, July 31st to August 9th, and August 12th to 17th.

Barometric pressure was moderately above normal in February, July, and December, and considerably above in September. It was considerably below in June and August. In the latter month it was 29<sup>ins.</sup>·530, or the lowest on record except in 1911 when it was 29<sup>ins.</sup>·521. The mean pressure for the year at station level was 29<sup>ins.</sup>·842 as against 29<sup>ins.</sup>·847 in 1918, and 29<sup>ins.</sup>·844 for the past 36 years. The highest pressure was 30<sup>ins.</sup>·398 on February 4th as against 30<sup>ins.</sup>·391 in 1918 and 30<sup>ins.</sup>·509 for the past 36 years. The lowest pressure was 29<sup>ins.</sup>·287 on August 26th as against 29<sup>ins.</sup>·108 in 1918 and 28<sup>ins.</sup>·735 for the past 36 years.

The temperature of the air was considerably above normal in March and April, and moderately above in June. It was moderately below in February, October, November, and December. The mean

temperature for the year was  $72^{\circ}2$  as against  $71^{\circ}2$  in 1918 and  $71^{\circ}8$  for the past 36 years. The highest temperature was  $92^{\circ}2$  on August 1st as against  $91^{\circ}2$  in 1918 and  $97^{\circ}0$  for the past 36 years. The lowest temperature was  $39^{\circ}4$  on February 4th as against  $42^{\circ}1$  in 1918 and  $32^{\circ}0$  for the past 36 years.

The rainfall was moderately above normal in July and August, and moderately below normal in May, June, and September. The total for the year was  $76\cdot140^{\text{ins.}}$  as against  $101\cdot605^{\text{ins.}}$  in 1918, and an average of  $83\cdot620^{\text{ins.}}$  for the past 36 years. The greatest fall in one civil day was  $4\cdot795^{\text{ins.}}$  on July 5th and the greatest in one hour was  $1\cdot350^{\text{ins.}}$  between 5 a.m. and 6 a.m. on October 1st.

The wind velocity was considerably below normal from February to June and from September to December. It was moderately above in July and August. The mean velocity for the year was 11·4 m.p.h. as against 11·6 m.p.h. in 1918 and 12·7 m.p.h. for the past 36 years. The maximum velocity for one hour as recorded by the Beckley Anemograph was 60 miles at 7 p.m. on August 22nd as against 63 miles in 1918 and 108 for the past 36 years. The maximum squall velocity, as recorded by the Dines-Baxendell Anemograph, was at the rate of 84 m.p.h. at 1h. 17m. p.m. on August 22nd as against 94 m.p.h. in 1918 and 105 m.p.h. for the past 10 years.

*Rainfall at Four Stations.*—In the following table the monthly rainfall for the year 1919 at the Observatory is compared with the fall at the Police Station, Taipo, the Botanical Gardens, and the Matilda Hospital, Mount Kellet:—

Months.	Observatory (Kowloon).	Police Station (Taipo).	Botanical Gardens (Hongkong).	Matilda Hospital (Hongkong).
	<i>inches.</i>	<i>inches.</i>	<i>inches.</i>	<i>inches.</i>
January, ....	0·625	0·72	0·85	0·69
February, ...	1·505	1·99	2·03	1·87
March, .....	1·755	2·04	1·77	1·47
April, .....	4·430	10·13	6·28	5·47
May, .....	6·950	12·24	7·43	6·38
June, .....	10·815	15·05	12·22	14·09
July, .....	19·430	18·56	22·39	16·93
August, .....	19·670	24·97	24·46	25·45
September,...	2·655	1·87	3·57	4·42
October, .....	4·695	3·80	4·66	4·10
November, ...	2·885	3·78	2·07	3·57
December, ...	0·725	0·77	2·03	1·08
Year,...	76·140	95·92	89·76	85·52



*Floods.*—The heaviest rainfall occurred at the Observatory as follows :—

<i>Period.</i>				<i>Amount.</i>	<i>Duration.</i>
				inches.	hours.
June.....	12 <sup>d</sup>	8 <sup>h</sup> to 14 <sup>d</sup>	22 <sup>h</sup> .....	5.200	20
July.....	3 <sup>d</sup>	14 <sup>h</sup> to 8 <sup>d</sup>	14 <sup>h</sup> .....	11.740	51
July.....	26 <sup>d</sup>	5 <sup>h</sup> to 29 <sup>d</sup>	14 <sup>h</sup> .....	7.600	43
August...	7 <sup>d</sup>	23 <sup>h</sup> to 11 <sup>d</sup>	20 <sup>h</sup> .....	6.825	32
August...	17 <sup>d</sup>	15 <sup>h</sup> to 24 <sup>d</sup>	13 <sup>h</sup> .....	7.420	40

*Typhoons.*—The tracks of 13 typhoons and 12 of the principal depressions which occurred in the Far East in 1919 are given in two plates in the Monthly Meteorological Bulletin for December, 1919. A depression, in the shape of a feeble typhoon, passed over Gap Rock on the early morning of June 13th. It caused no damage. A typhoon, which had been violent near the Paracels on July 30th to 31st, passed within a few miles to the south-west of Gap Rock on the evening of August 1st. It caused no damage here, as by this time it had nearly filled up. Typhoons of moderate intensity passed over Swatow in the early mornings of July 4th and August 10th, the first in a north-westerly and the second in a westerly direction. The centre of a severe typhoon passed about 150 miles to the south-west of Hongkong on a WNW track on the morning of August 22nd. A strong easterly gale occurred in Hongkong which caused a certain amount of damage to the shipping. A squall at the rate of 84 m.p.h. was recorded by the Dines-Baxendell anemograph at 1.17 p.m. on the 22nd.

#### IV.—PUBLICATIONS.

*Daily Weather Report and Map.*—A weather map of the Far East for 6 a.m. of the 120th meridian, and the Daily Weather Report (containing meteorological observations, usually at 6h. and 14h., from about 40 stations in China, Indo-China, Japan, the Philippines, and Borneo), and daily weather forecasts for Hongkong to Gap Rock, the Formosa Channel, the south coast of China between Hongkong and Lammocks, and between Hongkong and Hainan, were issued as in former years. Copies of the map were exhibited on notice boards at the Hongkong Ferry Pier, the Blake Pier, and the Harbour Office. One copy was sent daily to the Director of the Meteorological Observatory, Macao. Forty copies of the Daily Weather Report were distributed to various offices, etc., in the Colony, and a copy was sent daily to the Director of the Meteorological Observatory, Macao. Copies were sent every week to Lieutenant Pradiyat, Royal Siamese Navy.

A charge of \$10 a year is made for supplying private firms and individuals with the Daily Weather Report, and \$36 for the Weather Map. No maps were published on January 1, March 23, April 3 and 23, May 2, 4, 10, 12, and 13, June 22, 27, and 29, July 1, 10, 15, 25, and 26, August 13, September 15 and 21, October 5, and December 6, owing to the late arrival of the weather telegrams. On many other occasions the map, though published, contained but meagre information.

The weather forecast is telegraphed daily to the Cape d'Aguilar Wireless Station in time for distribution at 1 p.m. It is broadcasted again at 5 p.m.

*Monthly Meteorological Bulletin.*—The Monthly Meteorological Bulletin, which includes the Daily Weather Report, was published as usual, and distribution to the principal observatories and scientific institutions recommenced in November.

*Miscellaneous Returns.*—A monthly abstract of observations made at the Observatory is published in the *Government Gazette*, and daily, monthly, and yearly results are published in the Blue Book in the form suggested by the London Meteorological Office for the British Colonies.

The monthly departures from normal of the barometric pressure at four China Coast Ports were communicated to the Commonwealth Meteorologist, Melbourne, in connection with long range weather forecasts. Monthly meteorological returns are forwarded to Symons's Meteorological Magazine, and annual returns to the Stock Exchange Official Intelligence and the Colonial List.

#### V.—WEATHER TELEGRAMS, FORECASTS, AND STORM WARNINGS.

*Daily Weather Telegrams.*—The service of daily weather telegrams has improved somewhat of late, though the Japanese and Vladivostock morning observations are never received till the afternoon. The observations from Central and South China are received by post, the Chinese telegraphic service still being in a state of chaos.

*Extra Weather Telegrams.*—The following stations send extra weather telegrams at half rates during typhoons, on receipt of certain code words from Hongkong:—Amoy, Canton, Macao, Phulien, Sharp Peak, and Taihoku. The Director of the Philippines Weather Bureau also sends extra telegrams, at his discretion, from Aparri or some other station nearer the typhoon centre.

The extra 9 p.m. telegram, which the Chinese Telegraph Administration kindly send from Swatow during the typhoon season, was frequently not received.

*Wireless Weather Telegrams.*—The Marconi Company have generously renewed the offer made in 1916 to transmit meteorological telegrams from ships free of charge, and in July submitted a revised circular for issue to their operators. This circular was distributed to the various shipping companies in Hongkong, together with a notice to mariners, in the month of September. Copies of both are printed below.



Notice to Mariners.

1. The Marconi International Maritime Communication Company have issued the attached circular to their operators, and ship-masters are earnestly requested to co-operate in the forecasting and storm warning work of the Royal Observatory, Hongkong, by arranging for meteorological observations to be made in accordance with the programme given in the circular, and transmitted by the wireless operator without delay.

2. The accuracy and utility of the Observatory forecasts will increase in proportion to the number of ships co-operating, the accuracy of the observations, and the promptness with which they are despatched. In the interest of shipping, therefore, every master possessing a radio-telegraphic installation should send observations at the hours stated, *viz.*, 6 a.m. and 2 p.m. of the 120th Meridian Time, and endeavour to make the service as efficient as possible.

3. It is requested that mercurial barometers should be used whenever possible, and that owners should co-operate by supplying their ships with at least one good mercurial barometer, of the Board of Trade pattern. Very few aneroid barometers are satisfactory. Generally speaking, the index error varies considerably from time to time, and is seldom constant throughout the scale. Moreover their readings are usually affected by changes of temperature though they are supposed to be compensated in this respect.

In every case the readings should be followed by the word "Mercury" if a mercurial barometer is read, or "Aneroid" if an aneroid is read.

4. It is very important that a few readings (at least four) of the ship's barometer (the barometer used for the wireless messages) should be taken in Hongkong and forwarded to the Observatory, in order that the correction to the Observatory Standard may be obtained; otherwise the barometer readings are useless. It is also very important that the readings should be exactly as read off, without any correction whatever, except in the case of ships which have not sent comparison observations to the Observatory. Such ships should correct the readings for index error, and reduce them to 32° Fahrenheit, sea level, and gravity at 45° latitude; using the best index error available *and adding the word "corrected"*.

T. F. CLAXTON,  
*Director.*

26th September, 1919.

THE MARCONI INTERNATIONAL MARINE  
COMMUNICATION COMPANY, LIMITED.

CIRCULAR No. 364.

Operators employed on board ships trading to the Far East will note that arrangements have been made to transmit from the Cape d'Aguilar (Hongkong) Radiotelegraph Station to ships at sea a summary of meteorological conditions and weather forecasts. In return, ships will forward meteorological observations through the Cape d'Aguilar Station to the Royal Observatory, Hongkong.

Details of the arrangements are given hereunder :—

1. A summary of meteorological conditions and weather forecasts will be broadcasted by Cape d'Aguilar daily at 1 p.m. Hongkong standard time (5 a.m. G. M. T.) and repeated at 5 p.m. Hongkong standard time (9 a.m. G. M. T.).
2. Storm warnings are broadcasted at about noon and repeated every two hours until midnight. If a second warning is issued during the day the later warning will be substituted.
3. When within range of Cape d'Aguilar the Captain will arrange for observations to be made at 6 a.m. and 2 p.m. Hongkong time (10 p.m. and 6 a.m. G. M. T.), and a message, prepared by the observer, will be handed to the operator for transmission containing the following information :—
  - (a.) Ship's name, position, and the time of observation (G. M. T.).
  - (b.) Barometer reading (with no correction whatever).
  - (c.) Thermometer reading (if the barometer is of the mercurial type).
  - (d.) Wind direction and force.
  - (e.) State of weather (in plain language).

Under no circumstances will the operator write these messages.

4. Reports for transmission from the ship will be addressed to "Royal Observatory, Hongkong," and immediately on the acceptance of these messages the operator will enter (a) Prefix "S", (b) Date, (c) Time handed in (G. M. T.).
5. All messages handed in under the above conditions shall be dealt with as follows :—

They shall be communicated to the coast station at the first opportunity, and shall receive priority as Government messages.

The greatest care shall be observed to have them correctly transmitted; wherever possible, each message shall be repeated.
6. All messages shall be treated free of coast tax, ship tax, and land charges.



7. Reports handed in for transmission written on any form other than on the message form numbered SL shall be affixed to a message form SL in such a manner as not to occupy the space reserved for service instructions and other data.
8. The Hongkong Observatory also sends wireless Time Signals *via* Cape d'Aguilar at the even seconds between 11.54 p.m. and noon and between 8.54 p.m. and 9 p.m. Hongkong time (3.54 a.m. to 4 a.m. and 12.54 p.m. to 1 p.m. G. M. T.). The 2nd, 28th, 50th, 52nd, and 54th second of each of the above minutes are omitted for the purpose of identifying the signals.

The Time Signals are preceded by the following warning signals from Cape d'Aguilar between 11.54 a.m. and 11.55 a.m., and between 8.54 p.m. and 8.55 p.m., Hongkong time (3.54 a.m. and 3.55 a.m., and 12.54 p.m. and 12.55 p.m. G. M. T.). —

CQ DE VPS HK TIME WAIT

Both warning and Time Signals are sent out on a wave length of 1,900 metres from a 5 kw. spark set. The Time Signals are dots of about 0.2 second duration. Radio-telegraphic land and ship stations within range of Cape d'Aguilar are required to keep silent between 11.54 a.m. and noon, and 8.54 p.m. and 9 p.m. Hongkong time (3.54 a.m. and 4 a.m. and 12.54 p.m. and 1 p.m. G. M. T.) in accordance with Article 45, paragraph 3, of the Service Regulations appended to the International Radio-telegraph Convention of 1912. Operators are also required to keep themselves provided with the most accurate time available in order to know when to shut down.

9. The times given in brackets represent the G. M. T. equivalent of Hongkong standard time. The latter time is 8 hours in advance of G. M. T.

The Marconi International Marine

Communication Company, Limited,

*Marconi House*

Stampt, London, W.C. 2.

The following table gives the number of wireless meteorological messages received in each month from ships of different nationalities. It will be seen that the Circular has not met with a very hearty response so far.

Month.	<i>Dutch.</i>	<i>Japanese.</i>	<i>British.</i>	<i>American.</i>
January, .....	4	...	1	...
February, .....	4	...	...	...
March, .....	1	1	...	...
April, .....	2	1	...	...
May, .....	4	...	...	...
June, .....	5	...	...	...
July, .....	...	...	2	...
August, .....	4	...	3	...
September, .....	6	...	2	...
October, .....	1	1	1	1
November, .....	3	3	4	1
December, .....	2	...	4	...
Totals 1919,...	36	6	17	2
Totals 1918,...	41	14	...	...
Totals 1917,...	93	37	...	...
Totals 1916,...	95	60	...	...

*Results of Weather Forecasts.*—The results of the comparison of the daily weather forecasts with the weather subsequently experienced are given below, with the results of the previous five years :—

Year.	Complete Success.	Partial Success.	Partial Failure.	Total Failure.
	%	%	%	%
1914	62	32	5	1
1915	54	37	8	1
1916	67	29	3	1
1917	67	29	4	0
1918	71	26	3	0
1919	71	27	2	0

No forecasts were issued on July 28 and September 21, owing to lack of telegraphic information.

The forecast comprises wind direction, wind force, and weather.



Complete success means correct in three elements. Partial success means correct in only two elements. Partial failure means correct in only one element. Total failure means correct in no element.

The method of analysis is described in the 1918 Report.

*Storm Warnings*—Storm warnings, according to the Hong-kong Local and Non-Local Codes, are displayed at the Signal Hill, Kowloon. The following ports are warned by the non-local code:—Sharp Peak, Swatow, Amoy, Santiao, Macao, Canton, Wuchow, Pakhoi, Hoihow, Phulien, Taihook, Manila, Labuan, and Singapore.

The local day signals are repeated at the Harbour Office, H.M.S. *Tamar*, Green Island, the Godwin Company (Kowloon), Lyemun, and Lai-Chi-kok.

The local night signals are exhibited on the Observatory Wireless Mast and repeated on the tower of the Kowloon Railway Station, on H.M.S. *Tamar*, and at the Harbour Office.

For the benefit of native craft and passing ocean vessels a cone is exhibited at several outlying stations during the time that any of the local signals are displayed in the Harbour, to indicate that there is a depression somewhere in the China Sea, and that a typhoon warning is displayed in the Harbour.

In the following table are given the number of hours the local signals were hoisted in each of the years 1912–1919:—

Year.	Red Signals.	Black Signals.	Bombs.*
	Number of hours hoisted.		Number of times fired.
1912	151	164	...
1913	146	189	1
1914	146	178	...
1915	64	120	...
1916	7	231	1
1917	102	36	...
1918	33	132	1
1919	78	103	1

The figures in the above table include the number of hours that night signals, corresponding to the day signals, were hoisted.

Prior to July, 1917, the red signals indicated that the centre of the typhoon was believed to be more than 300 miles distant, and the black less than 300 miles; the returns for 1912–1916 are therefore not strictly comparable with those for 1917–1919. The latter suggest however that the use of the new local storm warning code has already saved the Colony a considerable amount of money. The loss incurred by the

\* Three bombs fired at intervals of 10 seconds indicate that wind of typhoon force is anticipated.

disorganisation of the work in the harbour, consequent upon the display of typhoon signals, is not easy to estimate. It probably amounts to many thousands of dollars a day, however.

#### VI.—METEOROLOGICAL OBSERVATIONS FROM SHIPS, TREATY PORTS, &c.

*Logs received.*—In addition to meteorological registers kept at about 40 stations in China, meteorological logs were received from 81 ships operating in the Far East. These logs, representing 2,587 days' observations, have been utilised for verifying typhoon tracks. The corresponding figures for the years 1918 were 34 and 2,223.

*Pilot Charts.*—No progress has been made with the construction of Pilot Charts as the Chief Assistant was largely occupied with re-organising the Time Service in the latter part of the year, and the First Assistant, who returned from Active Service on August 12th, was occupied in re-measuring sunshine records and comparing magnetic instruments with the Chief Assistant.

*Comparison of Barometers.*—During the year about 250 comparisons of ships' barometer have been made by means of observations taken when in harbour, and several direct comparisons of barometers for shipmasters and various persons in the Colony have been made at the Observatory.

#### VII.—MAGNETIC OBSERVATIONS.

The mean values of the magnetic elements for the years 1918 and 1919 were as follows :

	1918.	1919.
	" "	" "
Declination (west).....	0 17 57	0 19 50
Dip (north).....	30 48 19	30 47 30
Horizontal Force (C. G. S. unit)	0·37164	0·37171
Vertical Force (C. G. S. unit)	0·22159	0·22151
Total Force (C. G. S. unit) ...	0·43269	0·43270

The old magnetic hut is about to be demolished and the site used for quarters for the European Assistants.

In order to avoid a break in the series of magnetic observations, comparisons for horizontal force and declination are being made with Elliott No. 55 in the old hut and Elliott No. 83 in the new hut (constructed last year). Also for dip with Dover No. 71 in the old and new huts.

#### VIII.—TIME SERVICES.

*Time Ball.*—The Time Ball on the Signal Hill, Kowloon, is dropped daily at 13h Hongkong Standard Time (5 a.m. of Greenwich Time). The ball is also dropped at any other hour in case of necessity. No applications for a supplementary signal were made in 1919.



The ball was tripped successfully 361 times. There were 11 failures, 3 of which were caused by the negligence of the computers in charge at the tower who were fined. The remainder were due to electrical and mechanical defects. The days on which the ball failed to drop were:—January 22, March 23, May 3 and 19, June 22, July 1, 5, 8, 19, and 29, and December 7. It was dropped at 14h on January 22, July 6, and December 7, and at 15h on July 19.

The ball was not raised on July 1, 26, and 27, owing to high wind. The apparatus was in course of repair, or adjustment, on February 1, 5, 6, June 14 and 21, July 2, 6, and 7, August 20, and September 3 to 10.

The ball fell with an error of 0.3 sec. or less on 299 occasions, and with an error of 0.4 sec. or 0.5 sec. on 29 occasions. Errors of 0.6 sec. occurred 4 times, of 0.7 and 0.8 sec. each. The most probable error of the Time Ball was +0.015 sec. The monthly values for the past 5 years are given below:

Month.	Probable Error of the Time Ball.				
	1915	1916	1917	1918	1919
January, .....	± 0.17	± 0.15	± 0.17	± 0.14	± 0.24
February, .....	0.44	0.28	0.12	0.13	0.20
March, .....	0.17	0.17	0.11	0.11	0.12
April, .....	0.33	0.15	0.13	0.10	0.19
May, .....	0.16	0.15	0.17	0.11	0.14
June, .....	0.13	0.17	0.13	0.14	0.14
July, .....	0.17	0.15	0.20	0.11	0.13
August, .....	0.13	0.12	0.11	0.19	0.15
September, .....	0.13	0.11	0.12	0.15	0.16
October, .....	0.12	0.13	0.10	0.12	0.13
November, .....	0.16	0.13	0.13	0.12	0.14
December, .....	0.14	0.11	0.13	0.11	0.13
Means, .....	± 0.10	± 0.14	± 0.13	± 0.12	± 0.15

*Time Signals by Wireless Telegraphy.*—In addition to the time signals given by the Time Ball at 13h, signals are sent at noon and at 21h by wireless telegraph *via* Cape d'Aguilar. Particulars of the programme are given in the 1918 Report. The service has been interrupted rather frequently by circumstances over which the Observatory has no control.

*Wireless Receiving Set.*—Mr Henké, the officer detailed by the Naval Authorities to superintend the installation of a wireless receiving set at the Observatory, up to the time of his departure, in July, had not succeeded in obtaining time signals from Shanghai or Manila. Commander R. R. Cooke, R.N., is now reporting on what should be done to obtain these signals.

*Transit Instrument.*—Observations by time were made daily with the 3 inch transit instrument and the Hipparchus chronograph by the Chinese computers, weather permitting.

The number of observations in the years 1918 and 1919 were as follows :

	1918.	1919.
Transits, .....	1,522	1,321
Level determination, .....	787	676
Azimuth ..	23	23
Collimation ..	22	22

No transits of the Sun were utilized during 1919.

The azimuth and collimation determinations were made by the Chief and First Assistants from observations of the old south mark.

*Clocks.*—The losing rate of the Standard Sidereal clock, Dent No. 39741, varied from  $-0.12$  sec. on February 5 (Barometer  $30^{\text{ins.}}.33$  Temperature  $55^{\circ}.6$ ) to  $-0.55$  sec. on August 7 (Barometer  $29^{\text{ins.}}.48$  Temperature  $86^{\circ}.0$ ).

The rate during cloudy periods was usually derived from the formula :—

$$r = -0.792 + 0.575 (b - 29^{\text{ins.}}) + 0.00021 (t - 50)$$

where  $r$  is the computed losing rate, and  $b$  and  $t$  the mean barometric pressure and temperature, respectively, for the preceding 24 hours.

In the following table is given the excess of the observed over the computed error after cloudy periods during 1919 :—

Date 1919.		Interval without observations.	Excess of observed over computed error.
			<i>secs.</i>
January	11, .....	4 days	+ 0.28
"	15, .....	3 "	+ 0.64
"	29, .....	10 "	- 0.36
February	4, .....	5 "	- 0.16
"	15, .....	7 "	- 0.80
"	24, .....	5 "	+ 0.14
March	18, .....	10 "	+ 0.09
"	25, .....	5 "	- 0.01
April	4, .....	9 "	- 0.39
"	19, .....	9 "	+ 0.50
May	17, .....	9 "	- 0.24
"	26, .....	5 "	- 0.41
June	1, .....	3 "	0.00
"	18, .....	5 "	- 0.28
July	6, .....	3 "	- 0.08
"	29, .....	3 "	- 0.31
August	12, .....	3 "	+ 0.59
"	24, .....	3 "	- 0.09
"	29, .....	3 "	- 0.04
October	16, .....	5 "	- 0.57
"	22, .....	4 "	- 0.12
November	10, .....	4 "	+ 0.40
"	20, .....	4 "	- 0.41
December	3, .....	4 "	0.00
"	13, .....	5 "	+ 0.02



The Dent Mean Time clock (No. 39749) was used throughout the year for dropping the Time Ball, maintaining the electric time service to the Observatory, and sending hourly signals to the Railway, the Post Office, and the Eastern Extension Telegraph Co. The clock is connected daily at about 10 a.m. by the electric regular time apparatus, and its daily rate kept below 0.5 sec. by the addition or removal of weights from the pendulum. It gained 14 seconds in March 14, 12 seconds on November 20, and 27 seconds on November 21. It also tripped several times on December 23 and 24. The tripping on November 20 and 21 was caused by the driving weight suspension cord slipping from the pulley, and on the other occasions by undue pressure of the 2-second contact springs on the programme wheel.

The electric Sideral clock was mounted in the computing room in a wood and glass case on January 9, and adjusted to keep Mean time. It gives a 2-second impulse to a dial in the computing room, and to another in the Director's room. The clock has performed excellently, and has proved invaluable as a check on the performance of the minute dials.

Chronometer Dent No. 19617 is on loan to the Cape d'Agulhas Wireless Station, and chronometer Dent No. 39940 to the Peak Signal Station. Chronometer Woolf No. 5232 was forwarded for safekeeping to the Observatory by the Hon. Colonial Treasurer in August.

*Batteries, Power Supply, &c.* The necessary current for the Time Service has been supplied by accumulator batteries, charged as found necessary from the alternating mains of the China Light and Power Co., Ltd., through a Nodon valve. During March two Nodon valves of improved pattern and with larger electrodes were installed, those previously in use having become worn out. One of these valves is very satisfactory; the other is only efficient for very short periods.

*Constantly recurring electrical faults* led to a thorough examination of the electric installation by the Chief Assistant and Mr. Ovenden (of the Public Works Department). It was found that the earth return from the Time Ball was the cause of many of these faults; several defects were found on both the inner and outside circuits, and a defective main from the China Light and Power Company's system was discovered. These defects were remedied, and all earth returns abolished as soon as possible. All outside lines connected with the Observatory are now contained in a underground cable. In view of the leakage of alternating current to the clock and telegraph circuits the practice of using the battery during charging was discontinued, and the Fuller battery, hitherto reserved for the *de-accumulation*, was brought into use during the charging of the Tudor battery, and *vice versa*. One battery now supplies power for all requirements.

To give greatest effect to the new arrangements it was decided to undertake these in as simple a manner as possible, in a new switchboard, and to renew all interior wiring. This was

accordingly done by the China and Japan Telephone Co., who commenced re-wiring on October 31, and installed a new switch-board, designed by Mr. W. R. Noble, on December 19.

In December, 7 Delco cells were obtained to form, together with the 3 similar cells procured for the radio set, another 20 volt battery for alternate use with the Tudor battery installed in 1915. A motor-generator to replace the defective Nodon valve was also installed.

In March, 28 Fuller "block" cells of low capacity were purchased from H. M. Naval Yard for the valve of the Radio receiving installation. These cells have now deteriorated, and in anticipation of further deterioration 30 cells of the open type are on order from England.

#### IX.—MISCELLANEOUS.

*Staff.*—No change occurred in the European Staff during the year. Mr. B. D. Evans, First Assistant, returned from Military Service on August 12th.

The Director acted as Deputy Cable Censor from January 1st to March 28th, and as Cable Censor from March 29th until the abolition of the Censorship on July 23rd.

Cheng Wa So, 6th grade telegraphist, resigned on July 31st to take up a better appointment at Canton. His post was abolished and a 5th grade telegraphist, Leong Kwok Hoon, appointed on September 29th.

*Expenditure.*—The annual expenditure on the Observatory for the past ten years is as follows:—

Year.	Total Expenditure.	Increase.	Decrease.
	£   c.	£   c.	£   c.
1910	21,787.55	.....	601.08
1911	23,353.02	1,565.47	.....
1912	22,595.08	.....	757.94
1913	24,255.49	1,660.41	.....
1914	25,398.31	1,142.82	.....
1915	23,233.12	.....	2,165.19
1916	21,977.78	.....	1,255.34
1917	26,890.50	4,912.72	.....
1918	20,028.24	.....	6,862.26
1919	23,450.57	3,422.33	.....



*Acknowledgments.*—Acknowledgments are here made to the Directors of Weather Services in the Far East, and the Chinese Maritime Customs authorities, for daily observations, and extra observations during typhoon weather, to the Telegraph Companies for transmitting the observations free of charge, to the commanders of vessels who have furnished meteorological observations by post and by wireless telegraphy, and to the Observatory staff for the manner in which they have carried out their respective duties.

T. F. CLAXTON,  
*Director.*

1920, February 7.









